SHORT-PERIOD SEISMOMETER DEVELOPMENT A'T' j]'T]/

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Determining the structure of the interior of Mars has been a high priority for every Mars exploration strategy developed in the past 20 years, and is one of the primary goals of the InterMarsnet mission. Seismology is by far the most effective and detailed tool for investigating the radial and lateral distribution of density and elastic properties within a planet. Whereas long-period signals contain information from surface waves and normal modes from relatively large events, as well as the tidal response of the planet, the ability to record the high-frequency portion of the seismic spectrum ($0.05 \lesssim f \lesssim 50$ Hz) is essential for using the body waves of small to moderate events for probing the interior and analyzing the source characteristics of martian quakes.

The National Aeronautics and Space Administration is developing a suite of miniature seismometers and accelerometers for planetary and microgravity science. The Center for Space Microelectronics Technology at the Jet Propulsion Laboratory (J]'],) is using a combination of micromachining and novel transducer electronics to produce an ultra-sensitive instrument in a robust, compact, and low-power package. These instruments utilize a bulk micromachined single-crystalline silicon spring. An extremely sensitive symmetric ultra-high-frequency capacitive transducer is used to measure the displacement of the proof mass. The present generation of JPL seismometers based on this technology have been field tested, and have shown excellent performance compared to high-quality terrestrial instruments (Fig. 1).

The design criteria, structure, and fabrication techniques currently in use on the next generation microseismometer for use on Mars will be presented. The estimates for mass (<100 gm), power (<100 mW) and volume (20 cm^3) of this sensitive (better than 10^{-9} g/√Hz) three-component instrument make it well suited for small lander payloads. This seismometer is currently being proposed for both Mars Surveyor '98 and the RoLand Surface Science Package of Rosetta.

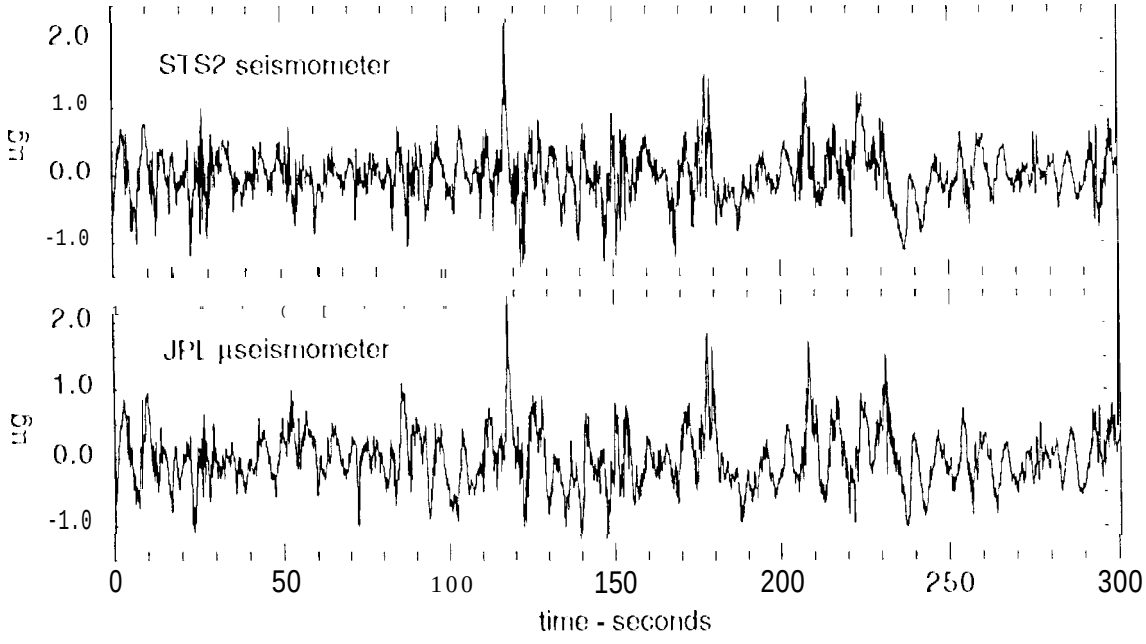

Fig. 1: Comparison of microseismic noise records from Streckeisen STS-2 seismometer and J]']. miniature seismometer taken simultaneously on March 10, 1995 at Piñon Flats, California.